

**FIRE PREVENTION EFFECTIVENESS:  
CAN WE MEASURE WHAT DID NOT HAPPEN?**

EXECUTIVE DEVELOPMENT

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## **ABSTRACT**

In 1973, the President of the United States commissioned a study of America's fire problem. The United States was suffering much greater losses in terms of fire deaths, injuries, and economic loss than other industrialized nations. The resulting report highlighted a need for the American fire service to place a greater emphasis on fire prevention. After the release of this report, the fire problem began to diminish. Fire prevention apparently had been making a positive impact on the nation's fire problem, but no one could prove the correlation. Fire departments were not trained to evaluate the effectiveness of their fire prevention efforts.

The fire service could not prove that increased efforts in fire prevention might result in further reductions in the fire problem because no conclusive data suggested that prevention caused the reductions in the first place. The lack of conclusive proof of prevention effectiveness has resulted in difficulty obtaining additional resources for fire prevention efforts in Anne Arundel County. This research project attempted to answer three questions. First, should the fire service be concerned with trying to measure the effectiveness of fire prevention? Second, are methods and criteria available that could be used to measure prevention efforts? Finally, are there methods and criteria that could be applied in Anne Arundel County EMS/ Fire/Rescue to measure the effectiveness of fire prevention?

A literature review was conducted of current and historical literature. The research revealed a wealth of material on why the fire service should evaluate fire prevention programs. The evidence was inconclusive that methods exist to make such evaluations. However, the research did show a need for the American fire service to improve data collection and use. These improvements could lead to better evaluative tools.

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## INTRODUCTION

Today's fire service managers are faced with growing pressures to provide better services with fewer resources. They also are being asked to show that they are providing cost effective service. The public is demanding to know that their tax dollars are being spent wisely.

In 1973, the President of the United States commissioned a study of America's fire problem in terms of deaths, injuries, and economic loss. The work of the commission resulted in the publication of the report America Burning (1973). This report defined the fire problem and detailed several steps that needed to be taken to solve the problem. The report was the impetus to the formation of the United States Fire Administration (USFA) in 1974. In 1987, the USFA conducted a workshop to reevaluate the fire problem and to review the progress made since the release of America Burning in 1973. Business and government organization representatives with an interest in fire protection attended the workshop. Several attendees had been members of the original commission. This workshop resulted in the publishing of the report America Burning Revisited (1987).

In the panel's discussion, the workshop attendees noted that the fire service began placing a greater emphasis on fire prevention after the release of America Burning (USFA, 1987). As they reported, before 1973, the United States experienced nearly 12,000 fire deaths annually. By 1975, the number of fire deaths declined to approximately 8,100; in 1985, deaths were down to 6,200; and in 1994, deaths were reported to be 4,275 (USFA). While this figure constitutes a significant decline, the United States still has one of the highest per capita fire death rates in the world (National Fire Data Center [NFDC], 1997). What is making the difference: smoke detectors, fire prevention, better suppression capabilities, or something else? If fire prevention is making a difference, the fire service needs to document and validate these achievements. Documentation is needed to build on successes, improve areas of weakness, and provide necessary evidence to support funding requests.

This research is going to explore a problem in Anne Arundel County regarding resources devoted to fire prevention. While the research was geared to finding an answer to a problem in Anne Arundel County, it may be revealing of a problem inherent to governmental entities providing fire service in the United States. The Anne Arundel County department of EMS/Fire/Rescue increased its emphasis on fire prevention in the middle 1970's. Inspectors were added to the Prevention Bureau staff and, in 1977, the department started the In-Service Inspection Program, using station personnel to conduct fire safety inspections of existing

buildings. The program continued to expand until the early 1980's, when bureau staffing and expansion of the in-service program leveled off.

Anne Arundel County structure fire response statistics show a significant drop for the department starting in the early 1990's (Appendix). At about the same time, the average number of fire deaths per year, over any five-year period, also began to show a decline. Interestingly, the three-year period from 1991-1993 showed an increase in total fire loss in dollar figures. There appears to be a problem understanding whether the fire prevention efforts of the 1970's and 1980's resulted in the drop in fire deaths and fire responses. Although a connection seems plausible, no evidence exists to demonstrate that the drop was not the result of other factors. If fire prevention resulted in fewer fires, why did Anne Arundel County experience an increase in dollar loss figures from fire during the same period?

Most private sector businesses measure effectiveness through profit. Measuring results in government seems to be more complex. In the case of fire prevention, the fire service is trying to measure what did not happen. As Osborne and Gaebler (1992) noted, "measuring results in business is fairly straightforward. Measuring results in government is not" (p. 349). The difficulty lies in defining the outcomes. In private sector business, the ultimate outcome is the bottom line; in government the outcomes are less apparent. Finding methods to measure the results of government programs is difficult.

Initially the intent of this research project was to determine the following: (1) whether the fire service should make the effort to measure fire prevention, (2) whether effectiveness evaluation for fire prevention programs can be accomplished and (3) whether there are methods adaptable to the Anne Arundel County department of EMS/Fire/Rescue to measure fire prevention efforts. However, the lack of research on measuring fire prevention effectiveness narrowed the focus of the project.

The descriptive research method was used to answer the following questions:

1. Should the fire service be concerned about documenting the effectiveness of fire prevention programs?
2. Can the effectiveness of fire prevention efforts be measured?
3. What criteria or methods are applicable and adaptable to measuring fire prevention effectiveness in the Anne Arundel County department of EMS/Fire/Rescue?

## **BACKGROUND AND SIGNIFICANCE**

The department of EMS/Fire/Rescue in Anne Arundel County is responsible for fire prevention. This function is dictated in the Anne Arundel County Charter, Article 18, Title 1, § 1-101. The department traditionally has carried out this function in three ways. First, departmental policy assigns inspectors to the Fire Marshal Division to inspect all new construction, except one and two-family dwellings. Second, the department uses Fire Marshal Division personnel to inspect existing buildings. Finally, suppression and other personnel engage in a program of in-service inspections to provide fire safety inspections of existing structures not being inspected by the Fire Marshal Division.

During the past ten years, staffing levels in the Fire Marshal Division have been stagnant. In fact, the division is staffed with one fewer inspector than was assigned in 1992. The number of inspections being conducted by in-service companies has remained relatively stagnant. But, the number of inspections being conducted by Fire Marshal division personnel has decreased. The decrease is due to both the loss of one inspector and an increased demand for new construction inspections. Anne Arundel County Fire Marshal Division statistical records show that about 7,100 inspections were conducted in 1992, and roughly 6,000 in 1997. During this same period, demands for new construction inspections increased dramatically. In “Building permits on ‘fast track,’” Pelton (1997) reported that the number of commercial building permits issued in Anne Arundel County during the last three years is double the number issued in the previous four years. The construction problem is two-fold. More construction requires more inspections during the construction phase. Adding to the problem is the fact that new fire alarm, fire sprinkler and clean-agent suppression systems are more complicated than they were in the past and take longer to inspect. New construction also creates more buildings that become existing buildings needing inspections. The increase in a need for inspection of new construction has caused a corresponding decrease in the number of existing building inspections being conducted. The department started a priority and frequency policy for inspections in 1993. Despite the department’s best efforts, the number of buildings overdue for inspection had reached almost 1,000 as of January 1998.

Requests for additional personnel for inspection services have not been funded. The number of positions allocated to suppression forces, however, has been increased during this period. In 1973, America Burning recognized the need to devote more resources to fire prevention. If proactive programs do make a difference, Anne Arundel County risks revisiting the fire problems of the 1970's if fire prevention is once again put on the back burner. Anne Arundel County is not alone in this dilemma. The fire service throughout the United States must remain focused on preventative measures or risk a return to the death and devastation that resulted in the formation of a national commission in 1973.

Anecdotal evidence suggests that the fire problem in Anne Arundel County has decreased since the 1970's and 1980's. Some of the decrease likely is attributable to changes in reporting methods. However, the decrease is significant and cannot be accounted for only in reporting changes. Some of the decline also must be attributable to fire prevention efforts.

In America Burning Revisited (1987), the report revealed that the fire problem has declined, and the decline in fires is usually observed to be the result of the efforts the fire service has made in fire prevention. However, the report also noted that little statistical data has been used to come to this conclusion (USFA). This seems to be reflective of the experience in Anne Arundel County. The fire problem is declining and much of the decline is attributed to fire prevention. However, little statistical data is available to support this conclusion.

Fire department personnel associated with prevention programs see a need for additional resources for fire prevention. However, efforts to secure more resources for fire prevention have been unsuccessful. This may be due to a lack of measurable performance correlating fire prevention with the decrease in the fire problem. In their study on measuring prevention effectiveness, Schaenmann, Hall, Schainblatt, Swartz and Karter (1977) noted:

There is increasing willingness and perceived need to devote more resources to fire prevention programs, such as pre-fire inspections. But because no satisfactory method has been available to measure the effectiveness of such programs in preventing fires, there has been no way to know whether the greatly increased resources being sought would produce desired results. (p. xi)

The assignment of credit for reducing the fire problem to the work of fire prevention is a reflection of the increases made in the effort since the 1970's. Twenty years later, some fire departments are seeing

stagnation and even cutbacks in the efforts of fire prevention.. Three jurisdictions around Anne Arundel County have made cutbacks. Similar efforts are being considered in Anne Arundel County.

Despite the recognition by the department's senior staff, that prevention has made a difference, resources have remained stagnant for prevention. In 1979, the department had 319 personnel assigned to suppression units and 7 assigned to prevention. The department employed 355 uniformed career personnel, making the prevention staff roughly 2% of the authorized positions. By 1985, the inspection staff had grown to ten personnel out of the 436 authorized uniformed department positions or roughly 2.3% of the staffing level. In 1997, of the 606 authorized uniformed positions in the department, 11 were assigned to fire prevention. This number represents less than 1.8% of departmental staffing at a time when construction in Anne Arundel County is on the rise.

Since station personnel also were responsible for conducting fire inspections, starting in 1977, there likely was an increase, over previous years, in the number of inspections being conducted. Accurate records of the number of inspections for 1977, 1978, or 1979 were not available. In 1986, however, prevention and station personnel conducted 4,771 fire safety inspections. In 1997, the department conducted just over 6,000 inspections. This is a small increase compared to the number of new buildings constructed during the same period.

I believe that the efforts made in prevention in the 1970's and 1980's did have an impact on the fire problem in the 1990's. If so, then it follows logically that a reduction in efforts toward prevention eventually will result in increases in the fire problem. The difficulty lies in finding a way to gauge the effects of fire prevention efforts. The Anne Arundel County department of EM/Fire/Rescue currently has no method to evaluate the impact. As such, if prevention efforts are reduced and the fire problem increases during the next several years, there is no way to show that the increase is the result of the reduction and is not attributable to other unrelated factors. In order to convince the chief and politicians of the need for additional resources, solid evidence that fire problem reductions resulted from prevention programs must be provided. It must also be shown clearly that the addition of resources to prevention will further reduce the fire problem.

The number of fire deaths in Anne Arundel County dropped from an average of 6.8 per year between 1975 and 1984, to an average of 5.1 between 1988 and 1997 (Appendix). Again, the reductions usually are attributed to prevention efforts. It follows logically then, that if prevention efforts are reduced the fire death

toll will rise. Property loss compared to the value of property being protected has been used in Anne Arundel County as a measurement the last few years. This gauge also has indicated a decrease in the fire problem. These measures have been put forward in an effort to show the benefits of fire prevention versus fire suppression. However, it can be argued that effective fire suppression also will have a positive impact on fire loss. If a fire department is going to argue that fire loss reductions are a function of prevention efforts, the argument must be supported by evaluation methodology that can be validated. The key to successful programs is the ability to evaluate effectiveness (Austin, 1993).

Recently, Anne Arundel County EMS/Fire/Rescue launched an effort to gain accreditation through the International Association of Fire Chiefs (IAFC). The IAFC accreditation package includes a section on fire prevention. The prevention section asks several questions and includes an entire segment on the availability of statistical data being collected and evaluated. A review of this material caused me to question how effectively the Anne Arundel County department of EMS/Fire/Rescue measures its prevention efforts.

My research is relevant to the *Executive Development* course in two areas. First, the research relates to Chapter 8, "Marketing in the Public Sector." This chapter is devoted to developing marketing strategies for public sector agencies. Marketing deals with getting the right service to the right customer. A major component of marketing is evaluation. In the evaluation phase, the organization must determine whether objectives are being met and if the objectives are appropriate. In short, the department needs to measure the effectiveness of fire prevention so it can better market the service to the public. This research seeks to answer those questions for fire prevention services provided by public sector organizations. Second, the research is relevant to Chapter 11, "Service Quality." The public has a right to expect that the fire service is providing them with the best protection, in an effective manner. Osborne and Gaebler (1992) noted that the public wants effective government. If the department is not measuring the results of what it does, it is not assuring the public they are receiving a worthwhile return for their investment.

The purpose of this research is to determine whether criteria or methods are available and adaptable to Anne Arundel County to evaluate the effectiveness of fire prevention efforts. This information is needed to determine whether the fire problem is being positively affected by fire prevention efforts.

## LITERATURE REVIEW

The literature review for this topic revealed few sources that provided specific information about how to measure fire prevention effectiveness. In fact, sources that did discuss effectiveness evaluation provided some conflicting information regarding the criteria that should be used. While most sources touted the need or importance of measuring effectiveness, one source doubted that measuring government programs was worth the cost.

Despite the fact that the fire service has known for twenty-five years that it needs to measure the effectiveness of fire prevention, my research found little in the way of results. From the start of the national effort toward better fire prevention, the need to evaluate was acknowledged. It is interesting to note that the Report of the National Commission on Fire Prevention and Control, America Burning (1973), recognized a need, even then, to use scientific data to find solutions to the nation's fire problem. Despite the recognition of the need to measure performance, there is little evidence of scientific use of data to advance fire prevention. In fact, the follow up report, America Burning Revisited (1987), recognized that there was a lack of conclusive data to prove fire prevention contributed to the decline in fires. This report came ten years after another effort to improve fire service effectiveness measures. The earlier report revealed that there is a perceived need to devote more resources to fire prevention, but a lack of satisfactory effectiveness measures prevent us from knowing whether increased resources would produce desired results (Schaenmann, et al., 1977). The lack of effectiveness measures is not due to the lack of information. Data is available documenting the national fire problem. Fire in the United States 1985-1994 is the ninth edition of a manual devoted to providing the nation's fire data (National Fire Data Center [NFDC], 1997).

Sources encouraging measurement stated three basic reasons. First, to show that a program in prevention is successful. This was noted by Schaenmann, Stambaugh, Rossomando, Jennings, and Perroni (1990), who suggested that eventually decision makers are going to want to know the bottom line if they are to be expected to continue support for a program. Austin (1993) agrees, noting that "the key to successful programs is the ability to evaluate effectiveness" (p. 8). Second, to support additional resources for programs by convincing fire service and government leaders of the cost-benefits of prevention. Schaenmann (1994) noted that perhaps the most compelling reason for program evaluation is the need to prove that fire prevention is worth additional resources. Fire prevention programs in the United States lag behind most

European programs in the percentage of budget resources committed to such programs. Podlubny (1992) argued similarly; he stated that “a full understanding that it is cheaper to prevent fires than fight fires has not truly penetrated senior management’s philosophy of management” (p. 7). Third, some sources noted that just the process of measuring results is important. Perhaps the most adamant arguments for measuring government programs can be found in Osborne and Gaebler (1992). One such argument they made is that “if you don’t measure results, you can’t tell success from failure” (p. 147). However, Henry (1992) discounted the importance of measuring results. In his book, he suggested that trying to use performance measures to evaluate governmental programs is not worth the necessary expense.

Most sources recognized that it is necessary to measure effectiveness and encouraged governmental agencies to adopt performance measures. I reviewed literature specific to the fire service, as well as references about public sector management in general. I found several suggested methods of performance measurement. None of the methods had been documented as effective in testing, other than for public education programs. Regarding public policy, Palumbo (1988) noted that numerous evaluation methods and techniques exist to measure governmental programs. Palumbo provides guidance on how to use these tools by citing examples of programs that did use them for evaluation. One suggested method is summative evaluation. Summative evaluation is aimed at measuring what difference a program makes. Other suggested evaluation methods are goal-free, utilization-focused, and formative. The author also critiqued each method. Henry (1992) discussed many of the same evaluation tools suggested by Palumbo. However, Henry pointed out that scientific and technical problems exist in the use of these tools in measuring government programs due to problems with research design, and with validity and measurement. In their book on Reinventing Government, Osborne and Gaebler (1992) provide an appendix devoted to measuring performance. They recommend that any attempt to measure performance of governmental programs should include both quantitative and qualitative analysis.

Some of the resource material specific to the fire service also provided suggestions for measuring performance. However, they provided conflicting information on what criteria should be used to measure fire prevention effectiveness. In his research, Austin (1993) stated that deaths and injuries should be the dominant criteria. However, Crawford, et al. (1997, September) focused on measuring percentages of inspections completed, appeals sustained, and other workload measures. Lea (1993) found that control

groups, a standard method of scientific study, were not feasible for measuring performance. He noted that this method of providing a controlled condition to one group, while withholding it from another, is not feasible for the fire service, because government is legally obligated to provide consistent enforcement of all laws within a given jurisdiction. In addition, Palumbo (1988) noted that government programs are not conducted in a controlled laboratory environment. As such, they are subject to events that make it difficult to distinguish program effects from other factors.

The research presented other problems in finding defensible methods of evaluation. Robertson (1989) noted that “measuring the success of fire prevention efforts is subject to many variables” (p. 213). One such variable is the level of growth in a community. New construction is of particular concern to the code enforcement efforts of fire prevention. This is a problem to be considered in Anne Arundel County where new commercial construction permits have increased dramatically (Pelton, 1997). Schaenmann (telephone interview, December 1, 1997) pointed out that the level of training of fire service personnel engaged in prevention efforts was another variable to be considered in measuring effectiveness.

Most of the work in the area of measuring fire prevention effectiveness has been attributed to Phillip Schaenmann, President of Tri-Data Corporation. Tri-Data has done research for the National Fire Protection Association (NFPA), the USFA, and a number of fire service delivery organizations. Schaenmann has been the lead author of several publications devoted to fire prevention and measuring fire service performance. I reviewed the discussion by Schaenmann, et al. (1977) on measuring fire service performance. It addressed several aspects of fire service performance. It also included a section specific to fire prevention. One suggested method that may have application in Anne Arundel County is random sampling. In a telephone interview with Mr. Schaenmann (telephone interview, December 1, 1997), he made comparisons to methods used in other countries, such as using a quality control inspector. He also suggested comparisons with similar jurisdictions, cause-relationship review, and recommended reviewing Proving Public Fire Education Works for general principles of evaluation (Schaenmann, et al., 1990). This publication breaks down evaluation into a hierarchy, assigning measurable aspects of a program a ranking. It suggested that these aspects provide a range of proof with “end results” being the strongest and “institutional change” being the weakest indication of effectiveness.

## **Summary**

Effectively, the literature review provided strong correlation between measuring effectiveness and program success and growth. My review also revealed several suggested methods for measuring government programs in general, and fire prevention programs specifically. However, I found no evidence of any method being validated during the research.

## **PROCEDURES**

The research procedures used in this paper started with a literature review at the Learning Resource Center (LRC) at the National Emergency Training Center (NETC) in Emmittsburg, Maryland in September 1997. I requested additional resources from the LRC by way of electronic mail on the Internet and they were obtained through inter-library loan. In addition, I conducted a literature review at the Anne Arundel County Public Library, my personal library, and the library at the Anne Arundel County Fire Training Academy and Fire Marshal's Office between October 1997 and February 1998. An electronic mail request was also made to NFPA for information on measuring fire prevention effectiveness. A return letter from NFPA suggested contacting Mr. Phillip Schaenmann, of Tri-Data Corporation, as an authority in the area of measuring performance in the fire service. I contacted Mr. Schaenmann and conducted a telephone interview on December 1, 1997.

I targeted two specific areas in conducting the literature review. First, I searched for credible sources on measuring effectiveness in government programs. The intention of this search was to find information relative to conducting evaluative measures of programs provided by governmental entities. Second, I searched for information specific to measuring fire prevention effectiveness. I reviewed materials for information on how to conduct program evaluation, as well as for information on the benefits, limitations, and problems associated with conducting program evaluation.

**Limitations**

This research was subject to several limitations. There are few available resources on measuring fire prevention effectiveness. The one source specific to this topic was published in 1977, making the information somewhat dated. I was able to speak with the primary author, however, to update the information.

Most other sources of information on effectiveness evaluation either emphasized the importance, without detailing how to measure, or provided information on how to measure programs that had definitive outcomes. Since most evaluation methodologies identified are targeted at measuring outcomes, I found most methods incompatible with measuring what does not occur.

The research was also limited by a time factor. I had six months to complete the research. This provided time for literature review and analysis, but did not allow for experimentation with any of the evaluative methods. I based my conclusions on an analysis of the information, without testing any of the theories.

It should also be noted that the term “fire prevention” might not mean the same thing to all fire service organizations. My twenty years of experience in the field of fire prevention has provided a familiarity with the prevention efforts of many departments. Some departments consider prevention to include a comprehensive plan review of all new construction, code enforcement during construction, fire safety inspections of existing structures, juvenile fire setter intervention, and a comprehensive public fire safety education program. Other departments may provide only one or two of these functions. The definition of fire prevention varies from department to department. The NFDC (1997) suggested that “the priorities for prevention programs must be tailored to location and purpose” (p. 3). Therefore, any conclusions based on this research must be tailored to the programs in use by a specific fire service agency.

## RESULTS

Through a descriptive based research methodology, I found that little work has been done in the area of performance measurements for fire prevention. The review of the material and the interview with Mr. Schaenmann did provide interesting insight into the questions posed at the beginning of this paper. However, no conclusive proof was found that fire prevention effectiveness could be measured. While I found several methods to conduct an effectiveness review, none included a testing element that documented their reliability.

### 1. **Should the fire service be concerned about documenting the effectiveness of fire prevention programs?**

What was clear in the research is that the fire service needs to find a way to measure the effectiveness of fire prevention. The United States suffers a higher fire rate, as well as higher fire death rates, than most European and Asian countries (Schaenmann, 1994). The United States also commits fewer resources, both in terms of dollars and staff time, to fire prevention activities than other industrialized countries (NFDC, 1997). The fire service in the United States apparently should learn from the experiences of countries that better emphasize fire prevention efforts. As the NFDC also suggested, industrialized European and Asian countries can provide valuable information to the United States in reducing the fire problem through fire prevention.

The American fire service does need to develop proven measures of performance for fire prevention. Recently a group of fire service leaders gathered under the banner of the Fire Marshals Association of North America in an attempt to develop evaluation measures for fire, rescue, and emergency services (Crawford, et al., 1997, September). In the report from the Fire Marshals meeting, Wayne Powell of the National Fire Academy was quoted as stating, "the effort to develop meaningful performance indicators for fire service programs in the United States goes back well over a hundred years" (Crawford, et al., p. 12). It is interesting that despite the long history of the fire service, it does not yet have a uniform set of standards with which to measure effectiveness.

American fire services typically spend less of their overall fire department budgets in prevention than do many other countries. This fact is revealed in the NFDC report on Fire in the United States 1985-1994, which noted:

*The vast majority of fire department resources are focused on fire suppression rather than on fire prevention.* It is estimated that less than 3 percent of all U.S. fire department budgets are allocated to prevention activities, whereas other industrialized countries are spending between 4 and 10 percent of their budgets on prevention. (p. 183)

If fire prevention advocates hope to obtain the resources needed for increased efforts in fire prevention, they must convince government leaders and fire service managers they will get a return for their dollar. In his research, Austin (1993) revealed that “fire service managers must be convinced of the importance of increased fire prevention activities before they can ask fire service employees and governing bodies to embrace increased effort in the area” (p. 2).

In today’s climate of taxpayer scrutiny, fire departments must gain public support. As Osborne and Gaebler (1992) pointed out, “if you can demonstrate results, you can win public support” (p. 154). Anne Arundel County’s tax cap is affecting the ability of government leaders to expand services. The taxpayer outlook that resulted in the tax cap, amplifies the importance of documenting success. The public must be convinced that they are getting the best value for their tax dollar. If they were convinced, government leaders would be less likely to focus efforts on programs without proven effectiveness.

## **2. Can the effectiveness of fire prevention efforts be measured?**

Program evaluation methods can be classified into two main categories, quantitative or qualitative. Quantitative measures express results in mathematical terms. Qualitative measures rely on personal familiarization with behavior (Palumbo, 1988). Most methods described in the researched literature were geared at quantitative measurement. Quantitative measures may be difficult to accomplish when trying to measure what did not happen. Perhaps this is why America Burning Revisited (1987), noted that “while conclusive data is not yet available, many experts feel that the increased emphasis on fire prevention has contributed to the declining number of reported fires and fire deaths” (pp. 92-93). In their work on measuring government programs, Osborne and Gaebler (1992) recommended that both quantitative and qualitative analysis be performed. They pointed out that this dual analysis helps avoid the service providers who play the numbers game. For instance, if numbers of inspections completed is used as a quantitative measure, this number counting provides no evaluation of the inspection itself. Counting inspections does not look to see if the inspection was thorough or effective, only that it was completed.

The research yielded no evidence that any department or group has attempted to prove the effectiveness of prevention through evaluation. As evidenced by the research, service program measurement is difficult. Osborne and Gaebler (1992) noted that “many people in government resist the idea of performance measurement because they have seen it done poorly” (p. 155). In addition to the difficulty, the length of time needed to realize the results might be a factor. The fire service is accustomed to seeing immediate results, such as the extinguishment of a fire. Osborne and Gaebler (1992) pointed out that measuring outcomes for any organization are not only very difficult, but that they may be not evident for years. The delay in seeing results may be especially true in the field of fire prevention. In measuring prevention, the daunting task of trying to measure what has not happened is added. Schaenmann (telephone interview, December 1, 1997) pointed out that it might take seven to eight years to fully realize the effects of fire prevention efforts. He also commented that it is easier to measure program effectiveness when the program is started, because a department has a baseline, without the program, against which to measure changes after the program has begun. It becomes harder to measure effectiveness after the program is in place, unless significant reductions or additions are made to the program (Schaenmann, telephone interview). Since most fire service organizations started prevention efforts after the 1973 report on the American fire problem, measuring the results of existing programs presents a challenge.

My research found little agreement on how to measure fire prevention effectiveness. In his research, Austin (1993) suggested that “fire deaths and injuries should be the dominant criteria for evaluating fire prevention success” (p. 3). The use of deaths, injuries, and dollar loss were also promoted by Podlubny (1992). In addition, Schaenmann, et al. (1990) placed these criteria at the top of the hierarchy of evaluation measures. However, using these criteria as a major factor, when code enforcement is a major part of the prevention effort, could be misleading. Most fire deaths and injuries occur in residential properties (NFDC, 1997). Since most code enforcement programs do not include residences, using these criteria does not provide a measure of the effectiveness of this aspect of fire prevention.

Another popular method found in use is dollar loss comparison. Measuring dollar loss also has problems, because of trend fluctuations and the fact that this measure is highly sensitive to a few very large fires (NFDC, 1997). A fire department might do an excellent job of preventing fires, reducing the number by half, only to have dollar loss rise because of one large loss fire. Using dollar loss can also be misleading

because of the need to evaluate the affect of inflation. Through my own observations, I know that the dollar figures recorded on fire reports are not always accurate. Inaccurate reporting of dollar loss makes the use of this criterion unreliable.

Schaenmann (telephone interview, December 1, 1997) suggested comparing fire incidents with the time frame of the last inspection. In this way, a department is making a direct correlation between a fire in a structure and the length of time since the last inspection. The use of this method is also implied in the IAFC accreditation process. The questionnaire asks whether data is being collected on the number of fires and fatalities in buildings inspected within various time frames. The connection between inspection time, and fires and fatalities leads to the conclusion that the IAFC are tying inspection effectiveness to the frequency of inspections. In his previous work, Schaenmann, et al. (1977) had also suggested this method. However, he went on to warn that:

Properties similar in fire risk are generally assigned the same inspection frequency. This means a comparison of fire rates in properties that differ in inspection frequency will not be able to determine how much of the difference would have been found even if there were no inspection program. (p. 77)

On the surface, this approach seems to make sense. It provides a direct correlation between inspections and fire incidence, but apparently has its flaws and is not recommended. Fire departments typically inspect those properties with higher fire hazards more frequently and doing so could skew the results. It may show that buildings that are inspected less frequently have fewer fires, when in reality this is because these buildings are less prone to fires.

Schaenmann (telephone interview, December 1, 1997) also suggested a comparison method of evaluation. This requires finding other jurisdictions with similar population and demographics to the jurisdiction being evaluated. He mentioned that ideally, a department would look for jurisdictions with different levels of fire prevention programs, some doing more prevention and some doing less. If those jurisdictions doing more prevention have fewer fires, less fire loss and fewer fire deaths and injuries, while those doing less prevention have a greater fire problem than the baseline jurisdiction, a correlation can be shown between effort and results. The research does not fully support this methodology. Effectiveness evaluations must consider what conditions might or would have been had the program not been in place (Henry, 1992). It is difficult to answer this question in reviewing the programs of another department

because, as the NFDC (1997) noted “the fire problem varies from region to region and state to state because of variations in climate, poverty, education, demographics and other factors” (p. 3). Another problem is understanding that other factors within the prevention program itself may differ. These factors include the types of programs being offered, personnel training, and any number of other major or minor differences. In addition, evaluation needs to address implementation, since it is at the level of execution that a program may or may not be successful (Henry, 1992). The difficulty in judging the level of execution in another department makes the comparative evaluation even more difficult. Another problem with the comparative method was suggested by Schaenmann (telephone interview, December 1, 1997) during the interview. He mentioned that the comparison approach also does not account for the continuing fire prevention effects achieved by the mere existence of the program. There is a global effect achieved when businesses know there is a regular inspection program because there is a degree of self-policing (Schaenmann, telephone interview).

Another approach suggested by Schaenmann, et al. (1977) is random sampling of fire incidence in inspected properties. Buildings in the inspection files are randomly selected and checked to see whether fires have occurred in those properties. The procedures are delineated on pages 78 through 84 of Procedures for Improving the Measurement of Local Fire Protection Effectiveness. This method seems to be best suited to larger jurisdictions. Small departments or departments with low incidence of fire may have difficulty selecting enough data to measure results properly. The random sampling procedure suggests selecting a period to measure that include at least one hundred fires and at least twenty fires in each of the occupancy types included in the study (Schaenmann, et al., 1977). Random sampling methodology was not found in any other literature reviewed during the research.

One source, Public Policy in America, detailed several evaluation methodologies. These included summative evaluation, goal-free evaluation, utilization-focused Evaluation, and formative evaluation (Palumbo, 1988). Summative evaluation measures the extent to which outcomes of a program contribute to the achievement of goals. This evaluation methodology appears closely related to the objectives of the random sample method reviewed in the previous paragraph. In the random sample method, the department is looking for a correlation between inspections conducted and fires prevented. As with other evaluation tools, one of the problems with this method is isolating the impacts of program outputs from other factors

(Palumbo, 1988). Again, the difficulty lies in trying to measure what has not happened, and that is difficult to quantify.

The other evaluation methods Palumbo (1988) defined--goal-free, utilization-focused, and formative--do not lend themselves readily to measuring the effectiveness of fire prevention either, although goal-free may have some potential benefits. Utilization-focused and formative evaluations focus on implementation and not on results. Goal-free evaluation, on the other hand, does not set out to define program goals at the outset; instead, it is focused on determining what the program has achieved and how those achievements are fulfilling the needs of society. Goal-free evaluation is more oriented to qualitative values, and may be a good supplement to a quantitative method. Osborne and Gaebler (1992) recommended the use of both quantitative and qualitative methods of evaluation.

Another possibility that Schaenmann (telephone interview, December 1, 1997) raised is that of evaluating the work done by the inspectors. This process requires having a supervisory inspector regularly conducting follow-up inspections. These inspections look for errors of omission, taking note if an inspector is finding only trivial violations, while missing major problems. Schaenmann (telephone interview) noted that this process is used effectively by the British. The practice of quality control may improve the level of inspection quality and ultimately result in better fire prevention, but fire departments still need to document results. I also reviewed the methods recommended by Schaenmann, et al. (1990) in their publication on measuring public fire education. While these methods had all been tested, they were tested on specific isolated programs. The explicit nature of each program provided a way to measure specific outcomes, something fire departments have been unable to identify in comprehensive fire prevention programs.

The research found no evidence that methods have been validated to measure fire prevention effectiveness. In fact, it is not easy for government to adopt performance evaluation techniques; at least thirty-seven barriers to doing so have been identified (Henry, 1992). These barriers may be why the fire service has not seen stronger efforts in validating fire prevention effectiveness measures. The research is inconclusive and in some cases contradictory. Perhaps the most troubling statement found in searching for an answer to this question was revealed by Robertson (1989) when he stated that:

Measuring the success of fire prevention efforts is subject to many variables. It is, in fact, extremely difficult, even with the most accurate records available, to measure results in the fire prevention field.

A number of attempts have been made; however, they have not produced entirely satisfactory results.  
(p. 213)

**3. What criteria or methods are applicable and adaptable to measuring fire prevention effectiveness in Anne Arundel County EMS/Fire/Rescue?**

Anne Arundel County has had a fire prevention program in place since the 1960's. The program has included inspections by suppression forces in conjunction with full-time inspectors since the late 1970's. The program has seen few changes especially during the past decade. Based on Schaenmann's comments, it is most difficult to measure the effectiveness of an existing prevention program (telephone interview, December 1, 1997).

The problem that initiated this research is a lack of additional resources in fire prevention programs. Any evaluation methodology needs to measure the impact of existing programs. Anne Arundel's existing program precludes using many of the methods that might be effective in measuring new programs or programs undergoing significant changes.

The method most adaptable to Anne Arundel County is the random sample method. Anne Arundel County is a large jurisdiction covering roughly 440 square miles. The department protects a population of about a half-million people and responds to about 600 structures fire calls per year. The department maintains thorough inspection files on all buildings subject to fire code requirements and these number in excess of twelve thousand. These files are essential since this method requires thorough inspection files for all buildings that are inspected (Schaenmann, et al., 1977). Using Schaenmann's comparison model, where comparisons are made to similar jurisdictions, might be another viable evaluation tool. The comparison method, however, does require significant data gathering from other jurisdictions. It is important to correlate results based on number of inspections per 1,000 buildings in each jurisdiction (Schaenmann, telephone interview, December 1, 1997).

Based on the recommendation of Osborne and Gaebler (1992) the department should also seek to evaluate the prevention efforts in a qualitative model. The goal-free methodology detailed by Palumbo (1988) has potential to be a useful approach to supporting the findings of the quantitative method chosen.

Regardless of the chosen methodology, utilizing statistical data accurately is difficult. Few fire departments have personnel who are trained as statisticians (Schaenmann, et al., 1990). The Anne Arundel County department of EMS/Fire/Rescue does not employ anyone specifically for this purpose.

## DISCUSSION

Despite the work by Schaenmann, et al. (1977), the reference from the Fire Marshals Quarterly (1997, September) leads me to believe that little work has been done in the area of measuring fire prevention effectiveness. The lack of research seems to be confirmed by the recognition in America Burning Revisited, on the lack of conclusive data to support fire prevention's role in the declining fire problem (USFA, 1987). The lack of additional materials on the subject also seems to support this observation. The difficulty associated with measuring performance may be one reason for the dearth of information. It may also be attributed to the cost of performing comprehensive studies. As Henry (1992) noted, "one of the debates about using performance measures, as well as other components of program evaluation, is that the results obtained are not worth the cost" (p. 178).

Other factors are probably just as significant in the reluctance among fire service leaders to conduct such studies. In reviewing the available material, it became apparent that I needed an understanding of statistical data and analysis to properly conduct such work. Few in the fire service are well versed in statistical analysis. During my work in obtaining a four-year fire science degree, I never took a statistics course. It is natural for people to shy away from problems of which they have little understanding. As Osborne and Gaebler observed, "many people in government resist the idea of performance measures because they have seen it done poorly" (p. 155). The use of statistical data in analysis is difficult, particularly in trying to measure prevention programs. If fire service personnel have little or no training in data analysis, then it logically follows that the use of data analysis in the fire service has not been done well. Since public sector fire service education and training does not focus on statistical analysis, it is little wonder there is a lack of evidence that it is being used effectively to measure fire prevention.

Measuring effectiveness in the fire service, particularly fire prevention, is important to ensuring that departments are meeting their mission. Crawford, et al, (1997, September) summarized this point: "when we

are efficient and effective at our basic public safety mission, then we'll know we're delivering the best product at the most reasonable cost and thereby better serving the citizens who are our customers" (p. 14). This research focuses on measures of effectiveness rather than efficiency. Efficiency and effectiveness are both important to the public. However, Osborne and Gaebler (1992) noted that while the public wants efficient government, it is more concerned with the effectiveness of government. The fire service needs to do a better job of documenting its effectiveness if it wants to improve the public's perception of the value in its programs.

Before any program evaluation is started, a department must define the desired outcomes it wants from a program. Schaenmann, et al. (1977) observed that "effectiveness measures are measures of the ultimate outcomes of the service" (p. xii). If a department does not know what it wants a program to achieve, it is difficult to determine whether goals were reached. This research is not the first to note a lack of definitive material in the area of measuring fire prevention effectiveness as opposed to measuring process. Lea (1993) noted in his research that:

Since there was no clearly defined unit of measure of output, it was generally difficult to meaningfully study the effectiveness of inspection programs or inspection program components. Most studies satisfied themselves with counting those things which readily lent themselves to quantification. Examples would be the number of buildings inspected, man hours expended per inspection, the frequency of inspection, etc. (p. 10)

Measuring fire prevention effectiveness needs to be about results. It should not be about measuring what a department does to try to achieve them. Osborne and Gaebler (1992) wrote that "if you don't measure results, you can't tell success from failure" (p. 147). Evaluating success also provides an opportunity to make prevention programs better. Crawford, et al. (1997, September) observed that "measuring the results of our efforts allows us to compare our efforts with benchmarks we set and then improve where we fall short" (p. 14).

Fire prevention programs are intended to reduce the fire problem proactively by attacking the root causes of fires, thereby reducing fire deaths, injuries, and property loss. To measure fire prevention effectiveness, the fire service needs to distinguish between fires that were the result of preventable causes and those with causes not likely to be prevented by the reach of a department's programs. This presents another

dilemma in the efforts to initiate effectiveness studies. As Schaenmann, et al. (1977) noted, fire investigation reports often attribute a fire to a mechanical defect but do not indicate whether the defect could have been recognized during an inspection.

It became clear during the research that the Anne Arundel County department of EMS/Fire/Rescue is measuring the process of doing fire prevention and not the effectiveness. The statistical data being collected is aimed at determining the number of inspections completed, number of plans reviewed, and other process information. The department needs to focus on the outcomes of the program if it is going to adequately evaluate the effectiveness of its prevention efforts.

Government and fire service leaders are under increasing pressures from the public to try new approaches. This is especially true in Anne Arundel County, where government has been under a voter mandated tax cap for several years. Measures used to assess the success or failure of these new programs must be able to differentiate between the effects of the program and uncontrollable conditions (Schaenmann, et al., 1977). It is important to be able to isolate the results to the effects of the program when the evaluation is subjected to public scrutiny. An evaluation program must be able to show that changes observed can be attributed to the program and not to trends outside the control of the program (Henry, 1992).

An important aspect of measuring prevention effectiveness is that of encouraging personnel to buy into and support programs. Most employees want to be effective and will do what is necessary to increase the impact of organizational programs, provided they are not made to feel they are on an assembly line (Osborne & Gaebler, 1992). The assembly line feeling can result when all a department measures is process (e.g., number of inspections, number of violations, etc.). Unfortunately, it is natural to focus on what it is an agency does, especially in rule-driven organizations (Osborne & Gaebler, 1992).

It is also important that the fire service measures success. In this way, a department will know when success has been achieved and can reward those employees who contribute to that success. Fire service managers, like any other, try to reward success. It makes sense to recognize accomplishments that encourage others to achieve similarly. However, when fire service managers recognize only those who make rescues, or do a particularly good job on a fire are they rewarding success? Osborne and Gaebler (1992) observed that:

Rewarding success may be common sense, but that doesn't mean it is common practice . . . . In public safety, we often reward failure when the crime rate rises; we give the police more money. If

they continue to fail we give them more . . . . rewarding failure creates bizarre incentives . . . . It encourages police departments to ignore the root causes of crime and simply focus on chasing criminals. (p. 149)

An analogy can be drawn to the fire service. Government rewards failure when it gives more money and personnel to fire departments to chase fires. The fire service would be more successful if it concentrated more resources toward the root causes of fire and prevented them from starting.

The fire service must overcome many obstacles to further the cause of preventing fires. Fire service leaders and government officials need to be convinced that fire prevention is as important, if not more important, than putting more people on fire engines. It is also important, however, that the fire fighters be convinced. Fire fighters are often threatened by fire prevention. They believe that being proactive could eventually eliminate the need for their services and reduce their impact on society. In short, they see working at fire prevention as working themselves out of business (Podlubny, 1992).

The fire service in the United States is well behind many other industrialized countries in their efforts in fire prevention. In comparing the resources devoted to prevention versus suppression, Schaenmann, et al. (1977) observed: “prevention measures are at least as important, and prevention programs probably have a greater need for more resources” (p. xiv). The disparity is evidenced by low staffing levels, poor application, and use of personnel resources. Lower levels of fire rates and deaths in other countries reflect their approach, making prevention a priority and appropriately staffing their prevention divisions (Podlubny, 1992). The fire service needs to prove the effectiveness of fire prevention, as opposed to saving lives and property through suppression efforts.

## RECOMMENDATIONS

The American fire service as a whole must turn to more efficient and effective methods of operation to survive the onslaught of technology, politicians, and budget demands and prove their productivity (Podlubny, 1992). To achieve this goal, the American fire service needs to improve its efforts in measuring programs to ensure the survival of the public fire department.

Fire service training, especially for officers, should include statistics courses. Fire service leaders need to have a better understanding of how to analyze data if they are going to use it effectively to measure the results of what they do. The fire service needs to standardize methods of data analysis particularly in the area of fire prevention to ensure appropriate comparisons. The evaluation of fire prevention is difficult at best and is open to personal style and interpretation (Austin, 1993). Standardization of evaluation methods and data collection can reduce the ability to skew the information with personal interpretation. Fire departments with the resources to employ specialists, should ultimately rely on experts trained in statistical analysis to conduct evaluations. Smaller departments may need to rely on existing staff or as Schaenmann, et al. (1990) suggested, one possibility might be to use local colleges or universities.

Fire departments in general must look at the various methods of evaluation and choose the one right for their particular situation. More options are available to fire departments to measure prevention effectiveness, if they are starting a program or making significant changes to a program. Whatever method is chosen, it is important that the evaluation be done systematically using the best research methodology available to find the real answer about how well a program or policy is working (Palumbo, 1988).

In Anne Arundel County, the best method appears to be the random sample method. This method eliminates the problems identified when the frequency of inspections is based on fire hazards. The Anne Arundel department of EMS/Fire/Rescue has a priority and frequency policy for inspections. The random sample approach should provide a picture of how the existing fire prevention program is impacting the fire problem in Anne Arundel County. To add a degree of validity, since there is no documentation of validation, it would be best to conduct a simultaneous evaluation using a second method. Two options are available. First, a comparison with similar departments appears to be well suited to a secondary study. Similar results in two separate studies would lend credibility to the data. In this way, quantitative results can be compared between the random sample and the comparison method. Second, the department may also

want to conduct an evaluation using the goal-free method. The goal-free method is qualitative, rather than quantitative, and would further validate the results of the quantitative studies, if similar results were shown.

I would also recommend that other departments conduct evaluations of their fire prevention programs and document the results. A database of information is needed on how fire prevention programs impact the fire problem. It is also important that other departments use a variety of evaluation methodologies. The use of more than one method is important to show that it is fire prevention making the difference and not a particular method of evaluation that appears to make it work. Standardization of statistical analysis, data collection, and program evaluation are important and should be a goal for the United States fire service. Standardization does not mean that only one method should be used for evaluation. It is essential that effectiveness be proven in more than one way to validate the results of any individual study. Different evaluation methodologies may also need to be developed that are suitable for a variety of programs. Choosing the right methodology for a type of program is important and it must consider implementation.

The work of documenting prevention effectiveness would also benefit from changes in investigation reporting. Rather than just listing fires as accidental, departments need to document those accidental fires that might easily be averted through prevention.

Osborne and Gaebler (1992) revealed that “the simple act of defining measures is extremely enlightening to many organizations . . . . People begin to ask the right questions, to redefine the problem they are trying to solve, and to diagnose that problem anew” (p. 147). The bottom line is the fire service needs measurement tools to evaluate fire prevention programs. The fire service made a strong commitment to fire prevention after the 1973 report America Burning, but no documentation exists to equate the fire prevention efforts with the reduction in the fire problem. Better efforts at documenting and proving the effectiveness of fire prevention are necessary. Without proof, the fire service may be destined to repeat the errors of the past and rely on reacting to fire emergencies rather than acting proactively to prevent them.

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## Appendix

# Anne Arundel County EMS/Fire/Rescue

**Table of Fire Problem Statistics**

<u>YEAR</u>	<u>Fire Deaths</u>	<u># of Structure Fires</u>	<u>Total Loss</u>
1975	13	Info. Not Available	Info. Not Available
1976	9	Info. Not Available	Info. Not Available
1977	5	1,812	\$5,040,481
1978	4	1,610	\$5,521,098
1979	6	1,641	\$6,854,351
1980	9	1,594	\$7,307,487
1981	6	932	\$8,751,297
1982	2	Info. Not Available	Info. Not Available
1983	8	2,584	\$6,440,348
1984	6	2,624	\$3,600,732
1985	7	3,649	\$3,376,955
1986	6	3,487	\$4,185,725
1987	2	3,967	\$4,483,483
1988	9	3,957	\$2,550,000
1989	2	Info. Not Available	Info. Not Available
1990	7	Info. Not Available	\$9,702,908
1991	5	803	\$12,680,799
1992	3	792	\$13,521,883
1993	6	734	\$12,999,361
1994	6	701	\$8,673,857
1995	3	648	\$9,727,512
1996	3	566	\$7,056,637
1997	5	Info. Not Available	Info. Not Available